Question Bank

1) Write down the comparison of open loop and closed loop control system.

2) Write short note on

   i. Significance of Laplace transform in control systems

   ii. Poles and zeros of a TF

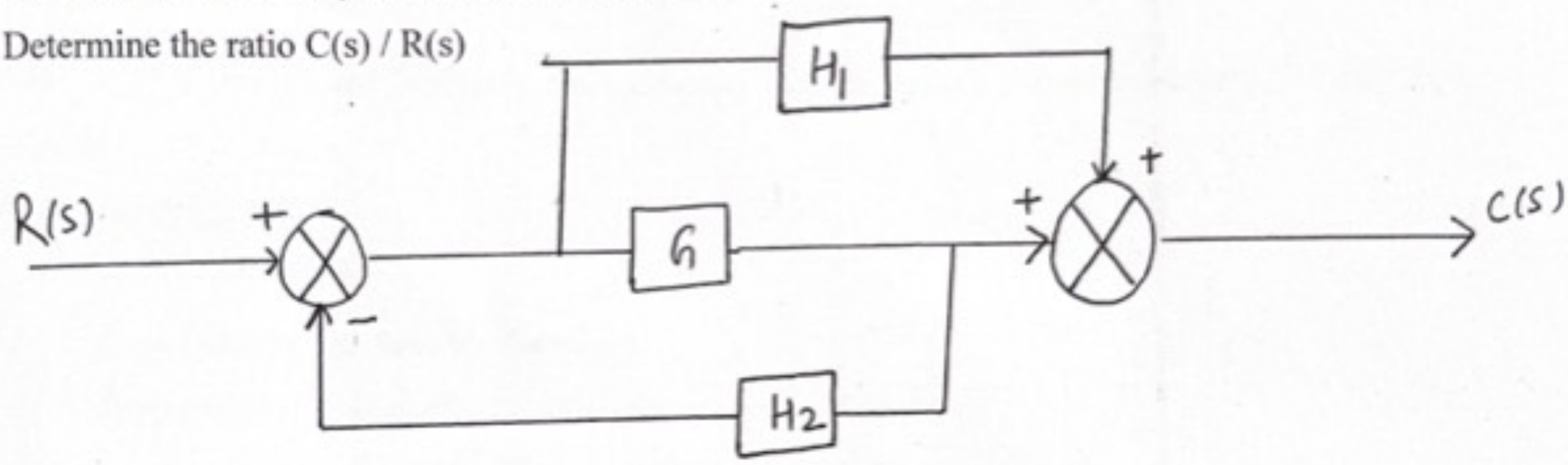
   iii. Benefits of feedback

3) Derive Expression for a first order controls system subjected to (i) Unit ramp input function (ii) Unit impulse input function

4) Derive expressions for a second order control system subjected to unit ramp input function and impulse input function

5) Write short note on any one industrial control example.

6) Determine the ratio C(s) / R(s)



7) When a second order control system is subjected to a unit step input the value of $\zeta = 0.5$ and $\omega_n = 6$ rad/sec. Determine the rise time, peak time, settling time and pea overshoot.

8) A feedback system is described by the following Transfer function

$G(s) = 12/S^2+4S+6$ $H(s) = kS$

The damping factor of the system is 0.8. Determine the overshoot of the system and the value of k.

9) Use the Routh stability criteria to determine the number of roots in the left half plane the right half plane and on the imaginary axis for the given characteristics equations

   i. $s^4+2s^3+8s^2+4s+3=0$

   ii. $s^4+9s^3+4s^2-36s-32=0$

10) The open loop TF of a unit feedback control system is given by

$G(s) = K/(s+2)(s+4)(s^2+6s+25)$ by applying Routh criteria, discuss the stability of the closed loop system as a function of K. Determine the value of K which will cause sustained oscillations un the closed loop system. What are the corresponding oscillations frequencies?

11) The characteristics equation of a servo system is given by

$a_0s^4 + a_1s^3 + a_2s^2 + a_3s + a_4 = 0$

12) Determine the conditions which must be satisfied by the coefficient of the characteristics equation for the system to be stable.

13) Sketch the root locus for G(s) = K/ s (s2+6s+2); H(s) =1

14) Draw the bode plot for.

G(s) = 23.7 (1+jω) (1+2jω) / (jω) (1+3 jω)(1+0.5 jω)(1+0.1 jω)

15) Draw the bode plot for

G(s) = 16 (1+0.5s) / s2 (1+0.125s)(1+0.1s)

Determine (i) phase cross over frequency (ii) gain cross over frequency (iii) PM and GM (iv) stability of the system.

16) Write short note on:

i. State space Model
ii. Eigen values and stability Analysis
iii. Discreet time system and its state space model.

17) Give an outline of specifications of controller design in the z-plane. Derive an expression for the steady state error to unit parabolic input. Develop an approach to obtain transient response specifications in terms of characteristics roots of the s-plane.

18) How disturbance rejection effectiveness can be studied for a closed loop transfer function. Discuss in detail about insensitivity and robustness in controller design.

19) Write short note on: (i) root locus on z-plane (ii) Digital compensator design using frequency response plots.

20) What are some common non-linear system behaviors? Also, Discuss in detail about some common non-linearities in control system.

21) What is the significance of performance indices to keep the system at an optimum level of performance? Define ISE, IAE, ITAE,, ITSE.

22) Discuss parameters optimization in servo mechanisms or tracking systems and output regulator problem.

23) Find the inverse Laplace transform :

i. $F(s) = 1/ s(s+1)$

ii. $F(s) = s+2 / s^2+4s+6$

24) Obtain the solution of differential equation given below:

i. $2\, dx/dt +8x=10$

ii. Given $x(0+) = 2$

25) A system is represented by a relation given below

$X(s)= R(s)\ 100/s^2+2s+50$

If $r(t) = 1.0$ unit. Find the value of $x(t)$ when t tends to ∞.

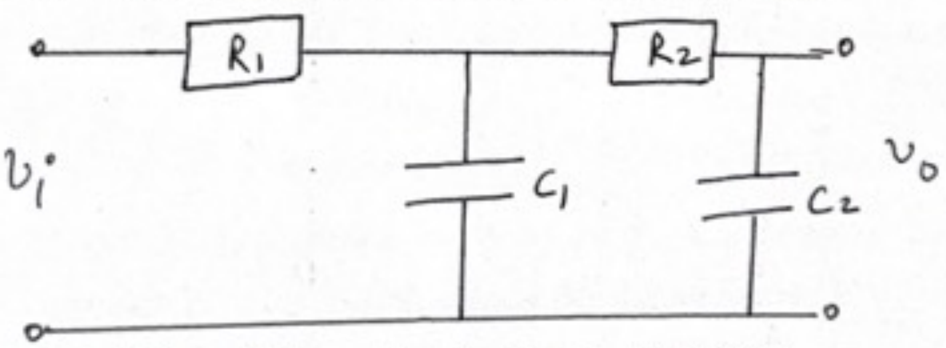
26) A series circuit consisting of resistance R and an inductance of L is connected to d c supply voltage of E. Derive an expression for the steady state value of current flowing in the circuit.

27) For the transfer function

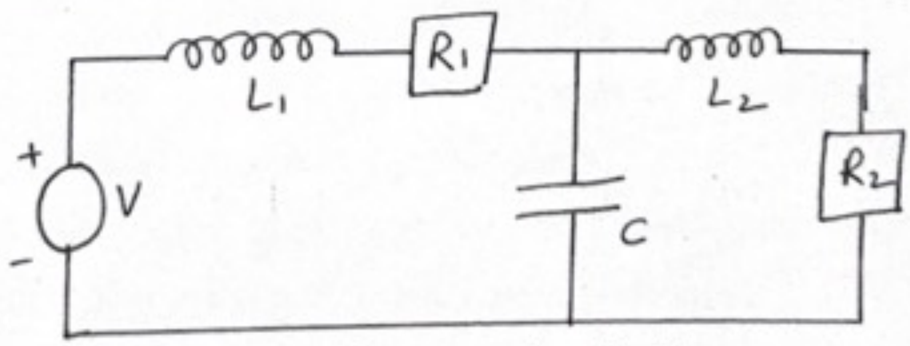
$G(s) = ½ (s^2+4)(1+2.5s) / s^2+2)(1+0.5s)$ Plot the poles and zeros in s-plane and determine the value of transfer function at s=2.

28) A torque T Nm is applied to a shaft having a moment of inertia J and coefficient of viscous friction 'f' produces an angle of θ radians. Obtain the transfer function relating θ and T.

29) Find the transfer function of electrical Network shown



30) Write the differential equation for the electrical N/W

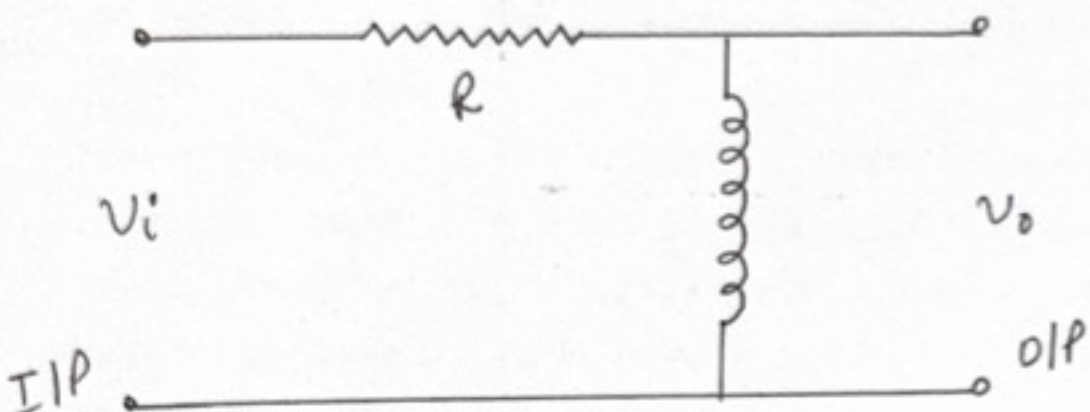


31) Find the transfer function of a system described by

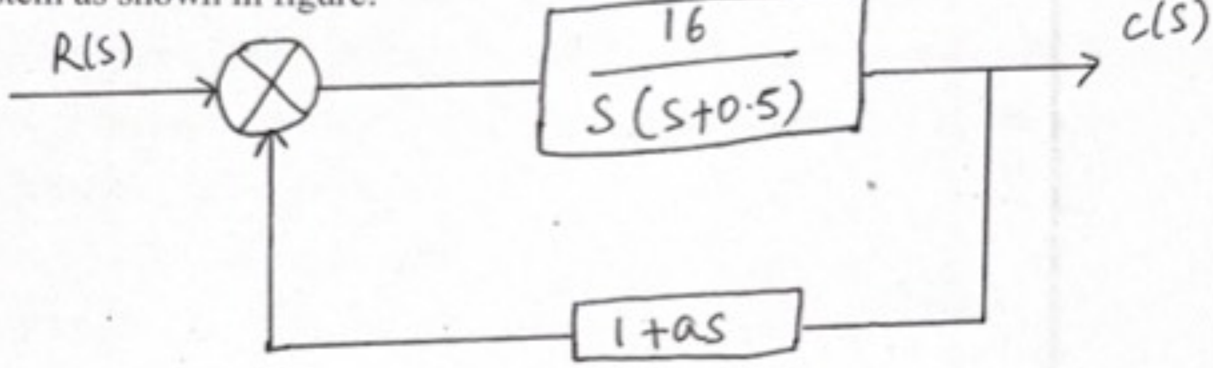
$2\, dc(t) / dt +c(t) = r(t-2)$

Where r(t) and c(t) are the input and output respectively.

32) Find the transfer function of given N/W.



33) Consider the system as shown in figure:



Determine the value of 'a' such that the damping ratio is 0.5. Also obtain the value of rise time and maximum overshoot Mp in its step response.

34) The open loop transfer function of a unity feedback controls system is given by

$G(s) = K/s(1+sT)$

By what factor, the amplifier gain K should be multiplied so that the damping ratio is increased from 0.3 to 0.9.

35) A system having a forward path TF is $G(s)= 16/s(s+1)$ and unity feedback. Determine the value of un damped natural frequency, damping ratio. If tachometer feedback is introduced, the feedback path TF becomes (1+Ks). What should be the value of K to obtain damping ratio of 0.6. Also calculate the percentage peak overshoot, first undershoot, tp and settling time within the 2% of final value.

36) The open loop TF of unity feedback system is $K/s(1+0.4s)(1+0.25s)$ Find the restriction of K so that the closed loop system is absolutely stable.

37) The characteristics equations for certain feedback control system are given below. In each case, determine the range of value K for the system to be stable

i. $s^4+20Ks^3+5s^2+10s+15=0$

ii. $s^3+2Ks^2+(K+2)+4=0$

38) Find the stability of system represented by following characteristics equation

$s^6+3s^5+5s^4+9s^3+8s^2+6s+4=0$

39) The characteristics equation of feedback control system is

$s^4+20s^3+15s^2+2s+K=0$

Determine the range of K for the system to be stable. Can the system be marginally stable? If so, Find the required value of K and the frequency of sustained oscillations

40) The forward path transfer function of a unity feedback system is given by $G(s) = K/s(s+4)(s+5)$. Sketch the root locus as K varies from zero to infinity.

41) A unity feedback control system has an open loop TF $G(s) = K/s(s^2+4s+13)$. Sketch the root locus plot of the system be determining the following (a) Centroid, if number and angle of asymptotes (b) Angle of departure of root loci from the poles (c) Breakaway point if any (d) the value of K and the frequency at which the root loci cross jω axis.

42) Sketch the bode plot for the transfer function

$G(s) = 1000/ (1+ 0.1s)(1+0.001s)$

Determine the (a) P.M. (b) gain margin (c) Stability of the system

43) Draw the bode plot for the transfer function

$G(s) = 50/ s (1+0.25s)(1+0.1s)$

From the graph determine

i. Gain crossover frequency
ii. Phase crossover frequency
iii. G.M and P.M
iv. Stability of system

44) Sketch the Nyquist plot and determine the stability of a unity feedback control system

$G(s) = K/(1+sT_1) (1+sT_2)$

45) Determine the closed loop stability of a control system whose open loop transfer function is $G(s) H(s) = K/s(1+sT)$